Scales

Device Description: _____

Contact Name: _____ Phone: _____

Company: _____ Address: _____

E-mail: _____ City: _____

Instructions For Completing Pre-Evaluation Checklists

You will usually need to complete **both** the "General" checklist and the specific checklist which is most applicable to your device or system type. For example, for a weighing device or weighing system the "General" checklist (which applies to all device types) and the "Scales" checklist should be completed. Both the "General" and "Watthour Meter" checklists should be completed and submitted with an electric watthour metering system application.

The exceptions are the computer software/hardware component pre-evaluation checklists which have the "General" requirements incorporated in them. Use the checklist for computer systems connected with either scales or measuring systems. Only one pre-evaluation checklist will be needed unless the software will be connected to both types of systems

These checklists include requirements extracted from the California Code of Regulations. Though not all-encompassing, the checklists contain requirements beyond those which would apply to any single device type or accessory. It is best to think of a device type as a weighing or measuring device system or as a component of such a system whichever best describes the device(s).

When applying the requirements to your device you have three options; Check

YES If your device or system complies
NO if the device or system does not comply.
NA if sections appear not to apply to the device or system type(s)

If selecting "**NO**", consider if your device or system is ready for evaluation. If the deficiency is of such a nature that it will not effect the ability to test for accuracy, such as failure to conform with marking requirements or lack of provision for sealing, the evaluation can probably begin while deficiencies are being corrected.

If you are not able to conduct accuracy testing your system or device is probably not yet ready for an evaluation.

I have reviewed the enclosed specifications, tolerances, and test notes for the device type for which we have applied for evaluation and approval. To the best of my knowledge I have determined the device meets all applicable requirements.

Signed: _____ Date: _____

Scales

A. Application.

A.1. General. - This code applies to all types of weighing devices other than automatic bulk-weighing systems and belt-conveyor scales. The code comprises requirements that are generally applicable to all weighing devices, and specific requirements that are applicable only to certain types of weighing devices.

A.2. Wheel-Load Weighers, Portable Axle-Load Weighers, and Axle-Load Scales. - The requirements for wheel-load weighers, portable axle-load weighers, and axle-load scales apply only to such scales in official use for the enforcement of traffic and highway laws or for the collection of statistical information by government agencies.

	Yes	No	NA
S. Specifications. **S.1. Design of Indicating and Recording Elements and of Recorded Representations.** **S.1.1. Zero Indication.** (a) On a scale equipped with indicating or recording elements, provision shall be made to either indicate or record a zero-balance condition. (b) On an automatic-indicating scale or balance indicator, provision shall be made to indicate or record an out-of-balance condition on both sides of zero. (c) A zero-balance condition may be indicated by other than a continuous digital zero indication, provided that an effective automatic means is provided to inhibit a weighing operation or to return to a continuous digital indication when the scale is in an out-of-balance condition.			
S.1.1.1. Digital Indicating Elements. (a) A digital zero indication shall represent a balance condition that is within ±1/2 the value of the scale division. (b) A digital indicating device shall either automatically maintain a "center-of-zero" condition to ±1/4 scale division or less, or have an auxiliary or supplemental "center-of-zero" indicator that defines a zero-balance condition to ± 1/4 of a scale division or less.			
S.1.1.2. No-Load Reference Value. - On a single draft manually operated receiving hopper scale installed below grade, used to receive grain, and utilizing a no-load reference value, provision shall be made to indicate and record the no-load reference value prior to the gross load value.			
S.1.2. Value of Scale Division Units. *- Except for batching scales and weighing systems used exclusively for weighing in predetermined amounts, the value of a scale division "d" expressed in a unit of weight shall be equal to:* *(a) 1, 2, or 5; or* *(b) a decimal multiple or submultiple of 1, 2, or 5; or* *(c) a binary submultiple of a specific unit of weight.* *Examples: Scale divisions may be 0.01, 0.02, 0.05; 0.1, 0.2, or 0.5; 1, 2, or 5; 10, 20, 50, or 100; or scale divisions may be 1/2, 1/4, 1/8, 1/16, etc.*			

Scales

	Yes	No	NA
S.1.2.1. Weight Units. *- Except for postal scales, a digital-indicating scale shall indicate weight values using only a single unit of measure. Weight values shall be presented in a decimal format with the value of the scale division expressed as 1, 2, or 5, or a decimal multiple or submultiple of 1, 2, or 5.*			
S.1.2.2. Verification Scale Interval. **S.1.2.2.1. Class I and II Scales and Dynamic Monorail Scales.** - If e ≠ d, the verification scale interval "e" shall be determined by the expression: $d < e \leq 10\ d$ If the displayed division (d) is less than the verification division (e), then the verification division shall be less than or equal to 10 times the displayed division. The value of e must satisfy the relationship, $e = 10^k$ of the unit of measure, where k being a positive or negative whole number or zero. This requirement does not apply to a Class I device with d < 1 mg where e = 1 mg. If e ≠ d, the value of "d" shall be a decimal submultiple of "e," and the ratio shall not be more than 10:1. If e ≠ d, and both "e" and "d" are continuously displayed during normal operation, then "d" shall be differentiated from "e" by size, shape, color, etc., throughout the range of weights displayed as "d."			
S.1.2.2.2. Class III and IIII. - The value of "e" is specified by the manufacturer as marked on the device. Except for dynamic monorail scales, "e" must be less than or equal to "d."			
S.1.3. Graduations. **S.1.3.1. Length.** - Graduations shall be so varied in length that they may be conveniently read.			
S.1.3.2. Width. - In any series of graduations, the width of a graduation shall in no case be greater than the width of the clear space between graduations. The width of main graduations shall be not more than 50 percent greater than the width of subordinate graduations. Graduations shall be not less than 0.2 mm (0.008 in) wide.			
S.1.3.3. Clear Space Between Graduations. - The clear space between graduations shall be not less than 0.5 mm (0.02 in) for graduations representing money values, and not less than 0.75 mm (0.03 in) for other graduations. If the graduations are not parallel, the measurement shall be made: (a) along the line of relative movement between the graduations at the end of the indicator; or (b) if the indicator is continuous, at the point of widest separation of the graduations.			
S.1.4. Indicators. **S.1.4.1. Symmetry.** - The index of an indicator shall be of the same shape as the graduations, at least throughout that portion of its length associated with the graduations.			
S.1.4.2. Length. - The index of an indicator shall reach to the finest graduations with which it is used, unless the indicator and the graduations are in the same plane, in which case, the distance between the end of the indicator and the ends of the graduations, measured along the line of the graduations, shall be not more than 1.0 mm (0.04 in).			

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	Yes	No	NA
S.1.4.3. Width. - The width of the index of an indicator in relation to the series of graduations with which it is used shall be not greater than: *(a) the width of the narrowest graduation,* (b) the width of the clear space between weight graduations, and (c) three-fourths of the width of the clear space between money value graduations. *When the index of an indicator extends along the entire length of a graduation, that portion of the index of the indicator that may be brought into coincidence with the graduation shall be of the same width throughout the length of the index that coincides with the graduation.*			
S.1.4.4. Clearance. - The clearance between the index of an indicator and the graduations shall in no case be more than 1.5 mm (0.06 in).			
S.1.4.5. Parallax. - Parallax effects shall be reduced to the practicable minimum.			
S.1.5. Weighbeams. **S.1.5.1. Normal Balance Position.** - The normal balance position of the weighbeam of a beam scale shall be horizontal.			
S.1.5.2. Travel. - The weighbeam of a beam scale shall have equal travel above and below the horizontal. The total travel of the weighbeam of a beam scale in a trig loop or between other limiting stops near the weighbeam tip shall be not less than the minimum travel shown in Tables 1 and 1M (see page 31). When such limiting stops are not provided, the total travel at the weigh-beam tip shall be not less than 8 percent of the distance from weighbeam fulcrum to the weighbeam tip.			
S.1.5.3. Subdivision. - A subdivided weighbeam bar shall be subdivided by scale division graduations, notches, or a combination of both. Graduations on a particular bar shall be of uniform width and perpendicular to the top edge of the bar. Notches on a particular bar shall be uniform in shape and dimensions and perpendicular to the face of the bar. When a combination of graduations and notches is employed, the graduations shall be positioned in relation to the notches to indicate notch values clearly and accurately.			
S.1.5.4. Readability. - A subdivided weighbeam bar shall be so subdivided and marked, and a weighbeam poise shall be so constructed, that the weight corresponding to any normal poise position can easily and accurately be read directly from the beam, whether or not provision is made for the optional recording of representations of weight.			
S.1.5.5. Capacity. - On an automatic-indicating scale having a nominal capacity of 15 kg (30 lb) or less and used for direct sales to retail customers: (a) the capacity of any weighbeam bar shall be a multiple of the reading-face capacity; (b) each bar shall be subdivided throughout or shall be subdivided into notched intervals, each equal to the reading-face capacity; and (c) the value of any turnover poise shall be equal to the reading-face capacity.			
S.1.5.6. Poise Stop. - Except on a steelyard with no zero graduation, a shoulder or stop shall be provided on each weighbeam bar to prevent a poise from traveling and remaining back of the zero graduation.			

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	Yes	No	NA
S.1.6. Poises. **S.1.6.1. General.** - No part of a poise shall be readily detachable. A locking screw shall be perpendicular to the longitudinal axis of the weighbeam and shall not be removable. Except on a steelyard with no zero graduation, a poise shall not be readily removable from a weighbeam. The knife edge of a hanging poise shall be hard and sharp and so constructed as to allow the poise to swing freely on the bearing surfaces in the weighbeam notches.			
S.1.6.2. Adjusting Material. - The adjusting material in a poise shall be securely enclosed and firmly fixed in position; if softer than brass, it shall not be in contact with the weighbeam.			
S.1.6.3. Pawl. - A poise, other than a hanging poise, on a notched weighbeam bar shall have a pawl that will seat the poise in a definite and correct position in any notch, wherever in the notch the pawl is placed, and hold it there firmly and without appreciable movement. The dimension of the tip of the pawl that is transverse to the longitudinal axis of the weighbeam shall be at least equal to the corresponding dimension of the notches.			
S.1.6.4. Reading Edge or Indicator. - The reading edge or indicator of a poise shall be sharply defined, and a reading edge shall be parallel to the graduations on the weighbeam.			
S.1.7. Capacity Indication, Weight Ranges, and Unit Weights. (a) Gross Capacity. An indicating or recording element shall not display nor record any values when the total platform load (not counting the initial dead load that has been canceled by an initial zero-setting mechanism) is in excess of 105 percent of scale capacity. *(b) Capacity Indication. Electronic computing scales (excluding postal scales and weight classifiers) shall neither display nor record a gross or net weight in excess of scale capacity plus 9d.* The total value of weight ranges and of unit weights in effect or in place at any time shall automatically be accounted for on the reading face and on any recorded representation. This requirement does not apply to: (1) single-revolution dial scales, (2) multi-revolution dial scales not equipped with unit weights, (3) scales equipped with two or more weighbeams, nor (4) devices that indicate mathematically derived totalized values.			
S.1.8. Computing Scales. **S.1.8.1.M. Money-Value Graduations, Metric Unit Prices.** - The value of the graduated intervals representing money values on a computing scale with analog indications shall not exceed: (a) 1 cent at all unit prices of 55 cents per kilogram and less; (b) 2 cents at unit prices of 56 cents per kilogram through $2.75 per kilogram (special graduations defining 5-cent intervals may be employed but not in the spaces between regular graduations); (c) 5 cents at unit prices of $2.76 per kilogram through $7.50 per kilogram; or (d) 10 cents at unit prices above $7.50 per kilogram. Value figures and graduations shall not be duplicated in any column or row on the graduated chart.			

Scales

	Yes	No	NA
S.1.8.1. Money-Value Graduations, Inch-Pound Unit Prices. - The value of the graduated intervals representing money values on a computing scale with analog indications shall not exceed: (a) 1 cent at all unit prices of 25 cents per pound and less; (b) 2 cents at unit prices of 26 cents per pound through $1.25 per pound (special graduations defining 5-cent intervals may be employed but not in the spaces between regular graduations); (c) 5 cents at unit prices of $1.26 per pound through $3.40 per pound; or (d) 10 cents at unit prices above $3.40 per pound. Value figures and graduations shall not be duplicated in any column or row on the graduated chart.			
S.1.8.2. Money-Value Computation. - A computing scale with analog quantity indications used in retail trade may compute and present digital money values to the nearest quantity graduation when the value of the minimum graduated interval is 0.005 kg (0.01 lb) or less.			
S.1.8.3.1. *Scales that will function as either a normal round off scale or as a weight classifier shall be provided with a sealable means for selecting the mode of operation and shall have a clear indication (annunciator), adjacent to the weight display on both the operator's and customer's side whenever the scale is operating as a weight classifier.*			
S.1.8.4. Recorded Representations, Point of Sale Systems. - The sales information recorded by cash registers when interfaced with a weighing element shall contain the following information for items weighed at the checkout stand: (a) the net weight; (b) the unit price; (c) the total price; and (d) the product class or, in a system equipped with price look-up capability, the product name or code number.			
S.1.9. Prepackaging Scales. **S.1.9.1. Value of the Scale Division.** - On a pre-packaging scale, the value of the intervals representing weight values shall be uniform throughout the entire reading face. The recorded weight values shall be identical with those on the indicator.			
S.1.9.2. Label Printer. - A prepackaging scale or a device that produces a printed ticket to be used as the label for a package shall print all values digitally and of such size, style of type, and color as to be clear and conspicuous on the label.			
S.1.10. Adjustable Components. - An adjustable component such as a pendulum, spring, or potentiometer shall be held securely in adjustment and, except for a zero-load balance mechanism, shall be located within the housing of the element.			

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	Yes	No	NA
S.1.11. Provision for Sealing. *(a) Except on Class I scales, provision shall be made for applying a security seal in a manner that requires the security seal to be broken before an adjustment can be made to any component affecting the performance of an electronic device.* *(b) Except on Class I scales, a device shall be designed with provision(s) for applying a security seal that must be broken, or for using other approved means of providing security (e.g., data change audit trail available at the time of inspection), before any change that detrimentally affects the metrological integrity of the device can be made to any electronic mechanism.* *(c) Except on Class I scales, audit trails shall use the format set forth in Table S.1.*11 (see page 24). A device may be fitted with an automatic or a semi-automatic calibration mechanism. This mechanism shall be incorporated inside the device. After sealing, neither the mechanism nor the calibration process shall facilitate fraud.			
S.1.12. Manual Gross Weight Entries. - *A device shall accept an entry of a manual gross weight value only when the scale is at gross load zero and the scale indication is at zero in the gross weight display mode. Recorded manual weight entries, except those on labels generated for packages of standard weights, shall identify the weight value as a manual weight entry by one of the following terms: "Manual Weight," "Manual Wt," or "MAN WT." The use of a symbol to identify multiple manual weight entries on a single document is permitted, provided that the symbol is defined on the same page on which the manual weight entries appear and the definition of the symbol is automatically printed by the recording element as part of the document.*			
S.1.13. Vehicle On-Board Weighing Systems: Vehicle in Motion. - When the vehicle is in motion, a vehicle on-board weighing system shall either: (a) be accurate, or (b) inhibit the weighing operation.			
S.2. Design of Balance, Tare, Level, Damping, and Arresting Mechanisms. **S.2.1. Zero-Load Adjustment.** **S.2.1.1. General.** - A scale shall be equipped with means by which the zero-load balance may be adjusted. Any loose material used for this purpose shall be enclosed so that it cannot shift in position and alter the balance condition of the scale.			

Scales

	Yes	No	NA
S.2.1.2. Scales Used in Direct Sales. - A manual zero-setting mechanism (except on a digital scale with an analog zero-adjustment mechanism with a range of not greater than one scale division) shall be operable or accessible only by a tool outside of and entirely separate from this mechanism, or it shall be enclosed in a cabinet. Except on Class I or II scales, a balance ball shall either meet this requirement or not itself be rotatable. A semiautomatic zero-setting mechanism shall be operable or accessible only by a tool outside of and separate from this mechanism or it shall be enclosed in a cabinet, or it shall be operable only when the indication is stable within: (a) plus or minus 3 scale divisions for scales of more than 2 000 kg (5 000 lb) capacity in service prior to January 1, 1981, and for all axle-load, railway track, and vehicle scales; or (b) plus or minus 1 scale division for all other scales.			
S.2.1.3. Scales Equipped With an Automatic Zero-Setting Mechanism. *- Under normal operating conditions the maximum load that can be "rezeroed," when either placed on or removed from the platform all at once, shall be:* *(a) for bench, counter, and livestock scales: 0.6 scale division;* *(b) for vehicle, axle-load, and railway track scales: 3.0 scale divisions; and* *(c) for all other scales: 1.0 scale division.*			
S.2.1.3.1. Automatic Zero-Setting Mechanism on Class III L Devices *- Class III L devices equipped with automatic zero setting mechanisms shall be designed with a sealable means to allow the automatic zero setting to be disabled during the inspection and test of the device.*			
S.2.1.4. Monorail Scales. - On a static monorail scale equipped with digital indications, means shall be provided for setting the zero-load balance to within 0.02 percent of scale capacity. On a dynamic monorail weighing system, means shall be provided to automatically maintain these conditions.			
S.2.1.5. Initial Zero-Setting Mechanism. (a) Scales of accuracy Classes I, II, and III may be equipped with an initial zero-setting device. (b) An initial zero-setting mechanism shall not zero a load in excess of 20 percent of the maximum capacity of the scale unless tests show that the scale meets all applicable tolerances for any amount of initial load compensated by this device within the specified range.			
S.2.1.6. Combined Zero-Tare ("O/T") Key. - Scales not intended to be used in direct sales applications may be equipped with a combined zero and tare function key, provided that the device is clearly marked as to how the key functions. The device must also be clearly marked on or adjacent to the weight display with the statement "Not for Direct Sales."			
S.2.2. Balance Indicator. - On a balance indicator consisting of two indicating edges, lines, or points, the ends of the indicators shall be sharply defined. When the scale is in balance, the ends shall be separated by not more than 1.0 mm (0.04 in).			

Scales

	Yes	No	NA
S.2.2.1. Dairy-Product-Test, Grain-Test, Prescription, and Class I and II Scales. - Except on digital indicating devices, a dairy-product-test, grain-test, prescription, or Class I or II scale shall be equipped with a balance indicator. If an indicator and a graduated scale are not in the same plane, the clearance between the indicator and the graduations shall be not more than 1.0 mm (0.04 in).			
***S.2.2.2. Equal-Arm Scale**. - An equal-arm scale shall be equipped with a balance indicator. If the indicator and balance graduation are not in the same plane, the clearance between the indicator and the balance graduation shall be not more than 1.0 mm (0.04 in).*			
S.2.3. Tare. - *On any scale (except a monorail scale equipped with digital indications), the value of the tare division shall be equal to the value of the scale division.* The tare mechanism shall operate only in a backward direction (that is, in a direction of under-registration) with respect to the zero-load balance condition of the scale. *A device designed to automatically clear any tare value shall also be designed to prevent the automatic clearing of tare until a complete transaction has been indicated.* *[Note: On a computing scale, this requires the input of a unit price, the display of the unit price, and a computed positive total price at a readable equilibrium. Other devices require a complete weighing operation, including tare, net, and gross weight determination.]*			
S.2.3.1. Monorail Scales Equipped with Digital Indications. - On a static monorail weighing system equipped with digital indications, means shall be provided for setting any tare value of less than 5 percent of the scale capacity to within 0.02 percent of scale capacity. On a dynamic monorail weighing system, means shall be provided to automatically maintain this condition.			
S.2.4. Level-Indicating Means. - Except for portable wheel- load weighers and portable axle-load scales, a portable scale shall be equipped with level-indicating means if its weighing performance is changed by an amount greater than the appropriate acceptance tolerance when it is moved from a level position and rebalanced in a position that is out-of-level in any upright direction by 5 percent (approximately 3 degrees). The level-indicating means shall be readable without removing any scale parts requiring a tool.			
S.2.4.1. Vehicle On-Board Weighing Systems. - A vehicle on-board weighing system shall operate within tolerance when the weighing system is out-of-level up to 3 degrees or 5 percent. If the accuracy of the system is affected by out-of-level conditions normal to the use of the device, the system shall be equipped with an out-of-level sensor that inhibits the weighing operation when the system is out-of-level to the extent that the accuracy limits are exceeded.			
S.2.5. Damping Means. - An automatic-indicating scale and a balance indicator shall be equipped with effective means to damp oscillations and to bring the indicating elements quickly to rest.			

Scales

	Yes	No	NA
S.2.5.1. Digital Indicating Elements. - Digital indicating elements equipped with recording elements shall be equipped with effective means to permit the recording of weight values only when the indication is stable within: (a) Plus or minus 3 scale divisions for scales of more than 2000 kg (5000 lb) capacity in service prior to January 1, 1981, hopper (other than grain hopper) scales with a capacity exceeding 22 000 kg (50 000 lb), and for all vehicle, axle load, livestock, and railway track scales. (b) Plus or minus 1 scale division for all other scales. The values recorded shall be within applicable tolerances.			
S.2.5.2. Jewelers', Prescription, and Class I and Class II Scales. - A jewelers', prescription, Class I, or Class II scale shall be equipped with appropriate means for arresting the oscillation of the mechanism.			
S.3. Design of Load-Receiving Elements. **S.3.1. Travel of Pans of Equal-Arm Scale.** - The travel between limiting stops of the pans of a nonautomatic-indicating equal-arm scale not equipped with a balance indicator shall be not less than the minimum travel shown in Tables 2 and 2M (see page 32).			
S.3.2. Drainage. - A load-receiving element intended to receive wet commodities shall be so constructed as to drain effectively.			
S.3.3. Scoop Counterbalance. - A scoop on a scale used for direct sales to retail customers shall not be counterbalanced by a removable weight. A permanently attached scoop-counterbalance shall indicate clearly on both the operator's and customer's sides of the scale whether it is positioned for the scoop to be on or off the scale.			
S.4. Design of Weighing Elements. **S.4.1. Antifriction Means.** - Frictional effects shall be reduced to a minimum by suitable antifriction elements. Opposing surfaces and points shall be properly shaped, finished, and hardened. A platform scale having a frame around the platform shall be equipped with means to prevent interference between platform and frame.			
S.4.2. Adjustable Components. - An adjustable component such as a nose-iron or potentiometer shall be held securely in adjustment. The position of a nose-iron on a scale of more than 1 000-kg (2 000-lb) capacity, as determined by the factory adjustment, shall be accurately, clearly, and permanently defined.			
S.4.3. Multiple Load-Receiving Elements. - Except for mechanical bench and counter scales, a scale with a single indicating or recording element, or a combination indicating-recording element, that is coupled to two or more load-receiving elements with independent weighing systems, shall be provided with means to prohibit the activation of any load-receiving element (or elements) not in use, and shall be provided with automatic means to indicate clearly and definitely which load-receiving element (or elements) is in use.			

Scales

	Yes	No	NA
S.5. Design of Weighing Devices, Accuracy Class. ***S.5.1. Designation of Accuracy Class.*** *- Weighing devices are divided into accuracy classes and shall be designated as I, II, III, III L, or IIII.*			
S.5.2. Parameters for Accuracy Class. *- The accuracy class of a weighing device is designated by the manufacturer and shall comply with parameters shown in Table 3 (see page 33).*			
S.5.3. Multi-Interval and Multi-Range Scales, Division Value. - On a multi-interval scale and multiple range scale, the value of "e" shall be equal to the value of "d."			
S.5.4. Relationship of Load Cell Verification Interval Value to the Scale Division. *- The relationship of the value for the load cell verification scale interval, v_{min}, to the scale division, d, for a specific scale installation shall be:* *(a)* $v_{min} \leq \frac{d}{\sqrt{N}}$ *where N is the number of load cells in the scale for scales without lever systems; and* *(b)* $v_{min} \leq \frac{d}{\sqrt{N} \text{ x (scale multiple)}}$ *for scales with lever systems* *[Note: When the value of the scale division, d, is different than the verification scale division, e, for the scale, the value of e must be used in the formulae above.]* *This requirement does not apply to complete scales and weighing elements which satisfy the following criteria:* *(1) The device has been evaluated for compliance with T.N.8.1. Temperature under the National Type Evaluation Program (NTEP);* *(2) The device has received an NTEP Certificate of Conformance; and* *(3) The device must be equipped with an automatic zero-setting mechanism which cannot be made inoperative in the normal weighing mode. (A test mode which permits the disabling of the automatic zero-setting mechanism is permissible, provided the scale cannot function normally while in this mode.)*			
S.6. Marking Requirements. ***S.6.1. Nominal Capacity; Vehicle, Axle-Load, and Livestock Scales.*** *- For all vehicle, axle-load, and livestock scales, the marked nominal capacity shall not exceed the concentrated load capacity (CLC) times the quantity of the number of sections in the scale minus 0.5. As a formula, this is stated as* *nominal capacity - CLC x (N - 0.5)* *where N = the number of sections in the scale.* [Note: When the device is used in a combination railway track and vehicle weighing application, the above formula shall apply only to the vehicle scale application.]			

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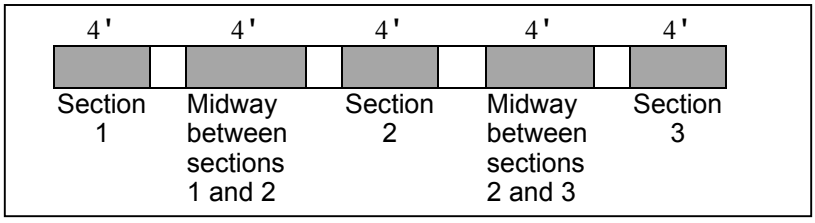
	Yes	No	NA
S.6.2. Location of Marking Information. - Scales that are not permanently attached to an indicating element, and for which the load-receiving element is the only part of the weighing/load-receiving element visible after installation, may have the marking information required located in an area that is accessible only through the use of a tool; provided that the information is easily accessible (e.g., the information may appear on the junction box under an access plate). The identification information for these scales shall be located on the weighbridge (load-receiving element) near the point where the signal leaves the weighing element or beneath the nearest access cover.			
S.6.3. Scales, Main Elements, and Components of Scales or Weighing Systems. - Scales, main elements of scales when not contained in a single enclosure for the entire scale, load cells for which Certificates of Conformance (CC) have been issued under the National Type Evaluation Program, and other equipment necessary to a weighing system, but having no metrological effect on the weighing system, shall be marked as specified in Table S.6.3.a. (see page 25) and explained in the accompanying notes [Table S.6.3.b (see page 26)].			
S.6.4. Railway Track Scales. - A railway track scale shall be marked with the maximum capacity of each section of the load-receiving element of the scale. Such marking shall be accurately and conspicuously presented on, or adjacent to, the identification or nomenclature plate that is attached to the indicating element of the scale.			
N. Notes. **N.1. Test Procedures.** **N.1.1. Increasing-Load Test.** - The increasing-load test shall be conducted on all scales with the test loads approximately centered on the load-receiving element of the scale, except on a scale having a nominal capacity greater than the total available known test load. When the total test load is less than the nominal capacity, the test load is used to greatest advantage by concentrating it, within prescribed load limits, over the main load supports of the scale.			
N.1.2. Decreasing-Load Test (Automatic Indicating Scales). - The decreasing-load test shall be conducted with the test load approximately centered on the load-receiving element of the scale.			
N.1.2.1. Scales Marked I, II, III, or IIII. - Except for portable wheel load weighers, decreasing-load tests shall be conducted on scales marked I, II, III, or IIII and with n equal to or greater than 1000 with test loads equal to the maximum test load at each tolerance value. For example, on a Class III scale, at test loads equal to 4000d, 2000d, and 500d; for scales with n less than 1000, the test load shall be equal to one-half of the maximum load applied in the increasing-load test.			
N.1.2.2. All Other Scales. - On all other scales, except for portable wheel load weighers, the decreasing-load test shall be conducted with a test load equal to one-half of the maximum load applied in the increasing-load test.			

Scales

	Yes	No	NA
N.1.3. Shift Test. **N.1.3.1. Bench or Counter Scales.** - A shift test shall be conducted with a half-capacity test load centered successively at four points equidistant between the center and the front, left, back, and right edges of the load-receiving element.			
N.1.3.2. Dairy-Product-Test Scales. - A shift test shall be conducted with a test load of 18 grams successively positioned at all points on which a weight might reasonably be placed in the course of normal use of the scale.			
N.1.3.3. Equal-Arm Scales. - A shift test shall be conducted with a half-capacity test load positioned on each pan as prescribed in N.1.3.1. An equal test load shall be centered on the other pan.			
N.1.3.4. Vehicle Scales, Axle-Load Scales, and Livestock Scales With More Than Two Sections. - At least one shift test shall be conducted with a minimum test load of 12.5% of scale capacity and may be performed anywhere on the load-receiving element using the prescribed test patterns and maximum test loads specified below. (Two-section livestock scales shall be tested consistent with N.1.3.8.) (a) **Prescribed Test Pattern.** - The normal prescribed test pattern shall be an area of 1.2 m (4 ft) in length and as wide as the scale platform. Multiple test patterns may be utilized when loaded in accordance with Paragraph (b). (b) **Maximum Loading.** - When loading the scale for testing, one side of the test pattern shall be loaded to no more than half of the concentrated load capacity or test load before loading the other side. The area covered by the test load may be less than 1.2 m (4 ft) x the width of the scale; for test patterns less than 1.2 m (4 ft) in length the maximum loading shall meet the formula: [(wheel base of test cart or length of test load divided by 48 in) x 0.9 x CLC]. The maximum test load applied to each test pattern shall not exceed the concentrated load capacity of the scale. When the test pattern exceeds 1.2 m (4 ft), the maximum test load applied shall not exceed the concentrated load capacity times the largest "r" factor in Table UR.3.2.1 (see pages 29 & 30) for the length of the area covered by the test load. For weighing elements installed prior to January 1, 1989, the rated section capacity may be substituted for concentrated load capacity to determine maximum loading. An example of a possible test pattern is shown below:  (c) **Multiple Pattern Loading.** - To test to the nominal capacity, multiple patterns may be simultaneously loaded in a manner consistent with the method of use. (d) **Other Designs.** - Special design scales and those that are wider than 3.7 m (12 ft) shall be tested in a manner consistent with the method of use but following the principles described above.			

Scales

	Yes	No	NA
N.1.3.5. Railway Track Scales Weighing Individual Cars in Single Drafts. - A shift test shall be conducted with at least two different test loads, if available, distributed over, to the right and left of, each pair of main levers or other weighing elements supporting each section of the scale.			
N.1.3.6. Monorail Scales, Static Test. - A shift test shall be conducted with a test load equal to the largest load that can be anticipated to be weighed in a given installation, but never less than one-half scale capacity. The load shall be placed successively on the right end, the left end, and the center of the live rail.			
N.1.3.6.1. Dynamic Monorail Weighing System. - Dynamic tests with livestock carcasses should be conducted to duplicate actual use conditions. No less than 20 test loads using carcasses or portions of carcasses of the type normally weighed should be used in the dynamic test; two additional test loads may be included in the test run for use in the event that one or two tests loads are rendered unusable during the dynamic test. Prior to starting the dynamic test, the test carcasses must be positioned far enough ahead of the scale so that their swaying motion settles to duplicate the normal sway of a continuously running plant chain. If the plant conveyor chain does not space or prevent the carcasses from touching one another, dynamic tests should not be conducted until this condition has been corrected. All carcasses shall be individually weighed statically on either the same scale being tested dynamically or another monorail scale with the same or smaller divisions and in close proximity. (The scale selected for weighing the carcasses shall first be tested statically with test weights.) If the scale being tested is used for weighing freshly slaughtered animals, (often referred to as a “hot scale”), care must be taken to get a static weighment as quickly as possible before or following the dynamic weighment to avoid loss due to shrink. If multiple dynamic tests are conducted using the same carcasses, static weights should be obtained before and after the multiple dynamic tests. If the carcass changes weight between static tests, the amount of the weight change should be taken into account, or the carcass should be disregarded for tolerance purposes.			
N.1.3.7. Vehicle On-Board Weighing Systems. - The shift test for a vehicle on-board weighing system shall be conducted in a manner consistent with its normal use. For systems that weigh as part of the lifting cycle, the center of gravity of the load may be shifted in the vertical direction as well as from side to side. In other cases, the center of gravity may be moved to the extremes of the load-receiving element using loads of a magnitude that reflect normal use (i.e., the load for the shift test may exceed one-half scale capacity), and may, in some cases, be equal to the capacity of the scale. The shift test may be conducted when the weighing system is out-of-level to the extent that the weighing system remains operational.			
N.1.3.8. All Other Scales Except Crane Scales, Hanging Scales, Hopper Scales, Wheel-Load Weighers, and Portable Axle-Load Weighers. - A shift test shall be conducted with a half-capacity test load centered, as nearly as possible, successively at the center of each quarter of the load-receiving element, or with a quarter-capacity test load centered, as nearly as possible, successively over each main load support.			
N.1.4. Sensitivity Test. - A sensitivity test shall be conducted on nonautomatic-indicating (weighbeam) scales only, with the weighing device in equilibrium at zero-load and at maximum test load. The test shall be conducted by increasing or decreasing the test load in an amount equal to the applicable value specified in T.2. or T.N.6.			

Scales

	Yes	No	NA
N.1.5. Discrimination Test. *- A discrimination test shall be conducted on all automatic indicating scales with the weighing device in equilibrium at zero load and at maximum test load, and under controlled conditions in which environmental factors are reduced to the extent that they will not affect the results obtained.*			
N.1.5.1. Digital Device. - On a digital device, this test is conducted from just below the lower edge of the zone of uncertainty for increasing load tests, or from just above the upper edge of the zone of uncertainty for decreasing-load tests.			
N.1.6. RFI Susceptibility Tests, Field Evaluation. - An RFI test shall be conducted at a given installation when the presence of RFI has been verified and characterized if those conditions are considered "usual and customary."			
N.1.7. Ratio Test. - A ratio test shall be conducted on all scales employing counterpoise weights and on nonautomatic-indicating equal-arm scales.			
N.1.8. Material Tests. - A material test shall be conducted on all customer-operated bulk weighing systems for recycled materials using bulk material for which the device is used. Insert into the device, in a normal manner, several accurately preweighed samples (free of foreign material) in varying amounts approximating average drafts.			
N.1.9. Zero-Load Balance Change. - A zero-load balance change test shall be conducted on all scales after the removal of any test load. The zero-load balance should not change by more than the minimum tolerance applicable.			
N.2. Verification (Testing) Standards. - Field standard weights used in verifying weighing devices shall comply with requirements of National Institute of Standards and Technology Handbook 105-1 (Class F) or the tolerances expressed in Fundamental Considerations, paragraph 3.2 (i.e., one-third of the smallest tolerance applied).			
N.3. Minimum Test Weights and Test Loads. **N.3.1. Minimum Test-Weight Load and Recommended Strain-Load Test for Railway Track Scales.** **N.3.1.1. Approval.** - The test-weight load shall be not less than 35 000 kg (80 000 lb). A strain-load test conducted up to the used capacity of the weighing system is recommended.			
N.3.1.2. Interim Approval. - A test-weight load of not less than 13 500 kg (30 000 lb) and a strain-load test up to at least 25 percent of scale capacity may be used to return a scale into service following repairs. Note: The length of time the scale may be used following an interim test is at the discretion of the official with statutory authority.			
N.3.1.3. Enforcement Action for Inaccuracy. - To take enforcement action on a scale that is found to be inaccurate, a minimum test load of 13 500 kg (30 000 lb) must be used.			

Scales

	Yes	No	NA
N.4. Coupled-in-Motion Railroad Weighing Systems. **N.4.1. Weighing Systems Used to Weigh Trains of Less Than 10 Cars.** - These weighing systems shall be tested using a consecutive-car test train consisting of the number of cars weighed in the normal operation run over the weighing system a minimum of five times in each mode of operation following the final calibration.			
N.4.2. Weighing Systems Placed in Service Prior to January 1, 1991, and Used to Weigh Trains of 10 or More Cars. - The minimum test train shall be a consecutive-car test train of no less than 10 cars run over the scale a minimum of five times in each mode of operation following final calibration.			
N.4.3. Weighing Systems Placed in Service on or After January 1, 1991, and Used to Weigh Trains of 10 or More Cars. (a) These weighing systems shall be tested using a consecutive-car test train of no less than 10 cars run over the scale a minimum of five times in each mode of operation following final calibration; or (b) if the official with statutory authority determines it necessary, the As Used Test Procedures outlined in N.4.3.1. shall be used.			
N.4.3.1. As Used Test Procedures - A weighing system shall be tested in a manner that represents the normal method of operation and length(s) of trains normally weighed. The weighing systems may be tested using either: *(1) a consecutive-car test train of a length typical of train(s) normally weighed; or* *(2) a distributed-car test train of a length typical of train(s) normally weighed.* *However, a consecutive-car test train of a shorter length may be used provided that initial verification test results for the shorter consecutive-car test train agree with the test results for the distributed-car or full-length consecutive-car test train as specified in N.4.3.1.1.* The official with statutory authority shall be responsible for determining the minimum test train length to be used on subsequent tests.			
N.4.3.1.1. Initial Verification. - Initial verification tests should be performed on any new weighing system and whenever either the track structure or the operating procedure changes. If a consecutive-car test train of length shorter than trains normally weighed is to be used for subsequent verification, the shorter consecutive-car test train results shall be compared either to a distributed-car or to a consecutive-car test train of length(s) typical of train(s) normally weighed. The difference between the total train weight of the train(s) representing the normal method of operation and the weight of the shorter consecutive-car test train shall not exceed 0.15 percent. If the difference in test results exceeds 0.15 percent, the length of the shorter consecutive-car test train shall be increased until agreement within 0.15 percent is achieved. Any adjustments to the weighing system based upon the use of a shorter consecutive-car test train shall be offset to correct the bias that was observed between the full-length train test and the shorter consecutive-car test train.			

Scales

	Yes	No	NA
N.4.3.1.2. Subsequent Verification. - The test train may consist of either a consecutive-car test train with a length not less than that used in initial verification, or a distributed-car test train representing the number of cars used in the normal operation.			
N.4.3.1.3. Distributed-Car Test Trains. (a) The length of the train shall be typical of trains that are normally weighed. (b) The reference weight cars shall be split into three groups, each group consisting of 10 cars or 10 percent of the train length, whichever is less. (c) The test groups shall be placed near the front, around the middle, and near the end of the train. (d) Following the final adjustment, the distributed-car test train shall be run over the scale at least three times or shall produce 50 weight values, whichever is greater. (e) The weighing system shall be tested in each mode of operation.			
N.4.3.1.4. Consecutive-Car Test Trains. (a) A consecutive-car test train shall consist of at least 10 cars. *(b) If the consecutive-car test train consists of between 10 and 20 cars, inclusive, it shall be run over the scale a minimum of five times in each mode of operation following the final calibration.* (c) If the consecutive-car test train consists of more than 20 cars, it shall be run over the scale a minimum of three times in each mode of operation.			
N.5. Uncoupled-in-Motion Railroad Weighing System. - An uncoupled-in-motion scale shall be tested statically before being tested in motion by passing railroad reference weight cars over the scale. When an uncoupled-in-motion railroad weighing system is tested, the car speed and the direction of travel shall be the same as when the scale is in normal use. The minimum in-motion test shall be three reference weight cars passed over the scale three times. The cars shall be selected to cover the range of weights that are normally weighed on the system and to reflect the types of cars normally weighed.			
N.6. Nominal Capacity of Prescription Scales. - The nominal capacity of a prescription scale shall be assumed to be 1/2 apothecary ounce, unless otherwise marked. (Applicable only to scales not marked with an accuracy class.)			
T. Tolerances Applicable to Devices <u>not</u> Marked I, II, III, III L, or IIII; **T.1. Tolerance Values.** **T.1.1. General.** - The tolerances applicable to devices not marked with an accuracy class shall have the tolerances applied as specified in Table T.1.1 (see page 28).			
T.1.2. Postal and Parcel Post Scales. - The tolerances for postal and parcel post scales are given in Table T.1.1 (see page 28) and Table 5 (see page 34).			
T.2. Sensitivity Requirement (SR) **T.2.1. Application.** - The sensitivity requirement (SR) is applicable to all nonautomatic-indicating scales not marked I, II, III, III L, or IIII, and is the same whether acceptance or maintenance tolerances apply.			

Scales

	Yes	No	NA
T.2.2. General. - Except for scales specified in paragraphs T.2.3. through T.2.8.: 2d, 0.2 percent of the scale capacity, or 40 lb, whichever is least.			
T.2.3. Prescription Scales. - 6 mg (0.1 grain).			
T.2.4. Jewelers' Scales. **T.2.4.1. With One-Half Ounce Capacity or Less.** - 6 mg (0.1 grain).			
T.2.4.2. With More Than One-Half Ounce Capacity. - 1d or 0.05 percent of the scale capacity, whichever is less.			
T.2.5. Dairy-Product-Test Scales. **T.2.5.1. Used in Determining Butterfat Content.** - 32 mg (0.5 grain).			
T.2.5.2. Used in Determining Moisture Content. - 19 mg (0.3 grain).			
T.2.6. Grain Test Scales. - The sensitivity shall be as stated in T.N.6.			
T.2.7. Vehicle, Axle-Load, Livestock, and Animal Scales. **T.2.7.1. Equipped With Balance Indicators.** - 1d.			
T.2.7.2. Not Equipped With Balance Indicators. - 2d or 0.2 percent of the scale capacity, whichever is less.			
T.2.8. Railway Track Scales. - 3d or 100 lb, whichever is less.			
T.3. Sensitivity Requirement, Equilibrium Change Required. - The minimum change in equilibrium with test loads equal to the values specified in T.2. shall be as follows: (a) Scale With a Trig Loop but Without a Balance Indicator. The position of rest of the weighbeam shall change from the center of the trig loop to the top or bottom, as the case may be. (b) Scale With a Single Balance Indicator and Having a Nominal Capacity of Less Than 250 g (500 b). The position of rest of the indicator shall change 1.0 mm (0.04 in) or one division on the graduated scale, whichever is greater. (c) Scale With a Single Balance Indicator and Having a Nominal Capacity of 250 kg (500 lb) or Greater. The position of rest of the indicator shall change 6.4 mm (0.25 in) or one division on the graduated scale or the width of the central target area, whichever is greater. However, the indicator on a batching scale shall change 3.2 mm (0.125 in) or one division on the graduated scale, whichever is greater. (d) Scale With Two Opposite-Moving Balance Indicators. The position of rest of the two indicators moving in opposite directions shall change 1.0 mm (0.04 in) with respect to each other. (e) Scale With Neither a Trig Loop nor a Balance Indicator. The position of rest of the weighbeam or lever system shall change from the horizontal, or midway between limiting stops, to either limit of motion.			

Scales

	Yes	No	NA
T.4. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility. - The difference between the weight indication with the disturbance and the weight indication without the disturbance, shall not exceed one scale division (d) or the equipment shall: (a) blank the indication; or (b) provide an error message; or (c) the indicator shall be so completely unstable that it could not be interpreted; or transmitted into memory or to a recording element, as a correct measurement value.			
T.5. Operating Temperature. *- An indicating or recording element shall not display or record any usable values until the operating temperature necessary for accurate weighing and a stable zero-balance condition has been attained.*			
T.N. Tolerances Applicable to Devices Marked I, II, III, III L, & IIII. **T.N.1. Principles.** **T.N.1.1. Design.** - The tolerance for a weighing device is a performance requirement independent of the design principle used.			
T.N.1.2. Accuracy Classes. - Weighing devices are divided into accuracy classes according to the number of scale divisions (n) and the value of the scale division (d).			
T.N.1.3. Scale Division. - The tolerance for a weighing device is related to the value of the scale division (d) or the value of the verification scale division (e) and is generally expressed in terms of d or e.			
T.N.2. Tolerance Application. **T.N.2.1. General.** - The tolerance values are positive (+) and negative (-) with the weighing device adjusted to zero at no load. When tare is in use, the tolerance values are applied from the tare zero reference; the tolerance values apply to certified test loads only.			
T.N.2.2. Type Evaluation Examinations. - For type evaluation examinations, the tolerance values apply to increasing and decreasing load tests within the temperature, power supply, and barometric pressure limits specified in T.N.8.			
T.N.2.3. Subsequent Verification Examinations. - For subsequent verification examinations, the tolerance values apply regardless of the influence factors in effect at the time of the conduct of the examination.			
T.N.2.4. Multi-Interval and Multiple Range (Variable Division-Value) Scales. - For multi-interval and multiple range scales, the tolerance values are based on the value of the scale division of the range in use.			
T.N.2.5. Ratio Tests. - For ratio tests, the tolerance values are 0.75 of the applicable tolerances.			

Scales

	Yes	No	NA
T.N.3. Tolerance Values. **T.N.3.1. Maintenance Tolerance Values.** - The maintenance tolerance values are as specified in Table 6 (see page 34).			
T.N.3.2. Acceptance Tolerance Values. - The acceptance tolerance values shall be one-half the maintenance tolerance values.			
T.N.3.3. Wheel-Load Weighers and Portable Axle-Load Weighers of Class IIII. - The tolerance values are two times the values specified in T.N.3.1. and T.N.3.2.			
T.N.3.4. Crane and Hopper (Other than Grain Hopper) Scales. - The maintenance and acceptance tolerances shall be as specified in T.N.3.1. and T.N.3.2. for Class III L, except that the tolerance for crane and construction materials hopper scales shall not be less than 1d or 0.1 percent of the scale capacity, whichever is less.			
T.N.3.5. Separate Main Elements: Load Transmitting Element, Indicating Element, Etc. - If a main element separate from a weighing device is submitted for type evaluation, the tolerance for the element is 0.7 that for the complete weighing device. This fraction includes the tolerance attributable to the testing devices used.			
T.N.3.6. Coupled-In-Motion Railroad Weighing Systems. - The maintenance and acceptance tolerance values for the group of weight values appropriate to the application must satisfy the following conditions:			
T.N.3.6.1. - For any group of weight values, the difference in the sum of the individual in-motion car weights of the group as compared to the sum of the individual static weights shall not exceed 0.2 percent.			
T.N.3.6.2. - If a weighing system is used to weigh trains of five or more cars, and if the individual car weights are used, any single weight value within the group must meet the following criteria: (a) no single error may exceed three times the static maintenance tolerance, (b) not more than 5 percent of the errors may exceed two times the static maintenance tolerance, and (c) not more than 35 percent of the errors may exceed the static maintenance tolerance.			
T.N.3.6.3. - For any group of weight values wherein the sole purpose is to determine the sum of the group, T.N.3.6.1. alone applies.			
T.N.3.6.4. - For a weighing system used to weigh trains of less than five cars, no single car weight within the group may exceed the static maintenance tolerance.			
T.N.3.7. Uncoupled-in-Motion Railroad Weighing Systems. - The maintenance and acceptance tolerance values for any single weighment within a group of noninteractive (i.e., uncoupled) loads, the weighment error shall not exceed the static maintenance tolerance.			

Scales

	Yes	No	NA
T.N.3.8. Dynamic Monorail Weighing System. - Acceptance tolerance shall be the same as the maintenance tolerance shown in Table 6 (see page 34). On a dynamic test of 20 or more individual test loads, 10 percent of the individual test loads may be in error, each not to exceed two times the tolerance. The error on the total of the individual test loads shall not exceed ± 0.2 percent.			
T.N.3.9. Materials Test on Customer-Operated Bulk Weighing Systems for Recycled Materials. - The maintenance and acceptance tolerance shall be ± 5 percent of the applied materials test load except that the average error on 10 or more test materials test loads shall not exceed ±2.5 percent.			
T.N.4. Agreement of Indications. **T.N.4.1. Multiple Indicating/Recording Elements.** - In the case of a scale or weighing system equipped with more than one indicating element or indicating element and recording element combination, where the indicators or indicator/recorder combination are intended to be used independently of one another, tolerances shall be applied independently to each indicator or indicator/recorder combination.			
T.N.4.2. Single Indicating/Recording Element. - In the case of a scale or weighing system with a single indicating element or an indicating/recording element combination and equipped with component parts such as unit weights, weighbeam and weights, or multiple weighbeams that can be used in combination to indicate a weight, the difference in the weight value indications of any load shall not be greater than the absolute value of the applicable tolerance for that load, and shall be within tolerance limits.			
T.N.4.3. Single Indicating Element/Multiple Indications. - In the case of an analog indicating element equipped with two or more indicating means within the same element, the difference in the weight indications for any load other than zero shall not be greater than one-half the value of the scale division (d) and be within tolerance limits.			
T.N.4.4. Shift or Section Tests. - The range of the results obtained during the conduct of a shift test or a section test shall not exceed the absolute value of the maintenance tolerance applicable and each test result shall be within applicable tolerances.			
T.N.4.5. Time Dependence. - At constant test conditions, the indication 20 seconds after the application of a load and the indication after 1 hour shall not differ by more than: (a) one-half of the absolute value of the applicable tolerance for the applied load for Class III L devices; and (b) the absolute value of the applicable tolerance for the applied load for all other devices.			
T.N.5. Repeatability. - The results obtained from several weighings of the same load under reasonably static test conditions shall agree within the absolute value of the maintenance tolerance for that load, and shall be within applicable tolerances.			
T.N.6. Sensitivity. - This section is applicable to all non-automatic-indicating scales marked I, II, III, III L, or IIII.			

Scales

	Yes	No	NA
T.N.6.1. Test Load. (a) The test load for sensitivity for nonautomatic-indicating vehicle, axle-load, livestock, and animal scales shall be 1d for scales equipped with balance indicators, and 2d or 0.2 percent of the scale capacity, whichever is less, for scales not equipped with balance indicators. (b) For all other nonautomatic-indicating scales, the test load for sensitivity shall be 1d at zero and 2d at maximum test load.			
T.N.6.2. Minimum Change of Indications. - The addition or removal of the test load for sensitivity shall cause a minimum permanent change as follows: (a) for a scale with trig loop but without a balance indicator, the position of the weighbeam shall change from the center to the outer limit of the trig loop; (b) for a scale with balance indicator, the position of the indicator shall change one division on the graduated scale, the width of the central target area, or the applicable value as shown below, whichever is greater: - Scale of Class I or II: 1 mm (0.04 in) - Scale of Class III or IIII with a maximum capacity of 30 kg (70 lb) or less: 2 mm (0.08 in) - Scale of Class III, III L, or IIII with a maximum capacity of more than 30 kg (70 lb): 5 mm (0.20 in); (c) for a scale without a trig loop or balance indicator, the position of rest of the weighbeam or lever system shall change from the horizontal or midway between limiting stops to either limit of motion.			
T.N.7. Discrimination. **T.N.7.1. Analog Automatic Indicating (i.e., Weighing Device With Dial, Drum, Fan, Etc.)**. A test load equivalent to 1.4d shall cause a change in the indication of at least 1.0d.			
T.N.7.2. Digital Automatic Indicating. - A test load equivalent to 1.4d shall cause a change in the indicated or recorded value of at least 2.0d. This requires the zone of uncertainty to be not greater than three-tenths of the value of the scale division.			
T.N.8. Influence Factors. - The following factors are applicable to tests conducted under controlled conditions only, provided that: (a) types of devices approved prior to January 1, 1986, and manufactured prior to January, 1, 1988, need not meet the requirements of this section; and (b) new types of devices submitted for approval after January 1, 1986, shall comply with the requirements of this section; and (c) all devices manufactured after January 1, 1988, shall comply with the requirements of this section.			
T.N.8.1. Temperature. - Devices shall satisfy the tolerance requirements under the following temperature conditions:			

Scales

	Yes	No	NA
T.N.8.1.1. If not specified in the operating instructions for Class I or II scales, or if not marked on the device for Class III, III L, or IIII scales, the temperature limits shall be: -10 °C to 40 °C (14 °F to 104 °F)			
T.N.8.1.2. If temperature limits are specified for the device, the range shall be at least that specified in Table T.N.8.1.2.			
T.N.8.1.3. Temperature Effect on Zero-Load Balance. - The zero-load indication shall not vary by more than: (a) three divisions per 5 °C (9 °F) change in temperature for Class III L devices; or (b) one division per 5 °C (9 °F) change in temperature for all other devices.			
T.N.8.1.4. Operating Temperature. - Except for Class I and II devices, an indicating or recording element shall not display nor record any usable values until the operating temperature necessary for accurate weighing and a stable zero balance condition have been attained.			
T.N.8.2. Barometric Pressure. - Except for Class I scales, the zero indication shall not vary by more than one scale division for a change in barometric pressure of 1 kPa over the total barometric pressure range of 95 kPa to 105 kPa (28 to 31 in of Hg).			
T.N.8.3. Electric Power Supply. **T.N.8.3.1. Power Supply, Voltage and Frequency.** (a) Weighing devices that operate using alternating current must perform within the conditions defined in paragraphs T.N.3. through T.N.7., inclusive, over the line voltage range of 100 V to 130 V or 200 V to 250 V rms as appropriate, and over the frequency range of 59.5 Hz to 60.5 Hz. (b) Battery operated instruments shall not indicate nor record values outside the applicable tolerance limits when battery power output is excessive or deficient.			
T.N.8.3.2. Power Interruption. - A power interruption shall not cause an indicating or recording element to display or record any values outside the applicable tolerance limits.			
T.N.9. Radio Frequency Interference (RFI) and Other Electromagnetic Interference Susceptibility. - The difference between the weight indication due to the disturbance and the weight indication without the disturbance shall not exceed one scale division (d); or the equipment shall: (a) blank the indication, or (b) provide an error message, or (c) the indication shall be so completely unstable that it cannot be interpreted, or transmitted into memory or to a recording element, as a correct measurement value. The tolerance in T.N.9. is to be applied independently of other tolerances. For example, if indications are at allowable basic tolerance error limits when the disturbance occurs, then it is acceptable for the indication to exceed the applicable basic tolerances during the disturbance.			

Scales

Table S.1.11 Categories of Device and Methods of Sealing	
Categories of Device	*Method of Sealing*
Category 1: No remote configuration capability.	*Seal by physical seal or two event counters: one for calibration parameters and one for configuration parameters.*
Category 2: Remote configuration capability, but access is controlled by physical hardware. *Device shall clearly indicate that it is in the remote configuration mode and record such message if capable of printing in this mode.*	*The hardware enabling access for remote communication must be at the device and sealed using a physical seal or two event counters: one for calibration parameters and one for configuration parameters.*
Category 3: Remote configuration capability access may be unlimited or controlled through a software switch (e.g., password).	*An event logger is required in the device; it must include an event counter (000 to 999), the parameter ID, the date and time of the change, and the new value of the parameter. A printed copy of the information must be available through the device or through another on-site device. The event logger shall have a capacity to retain records equal to ten times the number of sealable parameters in the device, but not more than 1000 records are required.* ***(Note: Does not require 1000 changes to be stored for each parameter.)***

Scales

Table S.6.3.a
Marking Requirements

Weighing Equipment To Be Marked With	Weighing, load-receiving, and indicating element in same housing	Indicating element not permanently attached to weighing and load-receiving element	Weighing and load-receiving element not permanently attached to indicating element	Load cell with CC (11)	Other equipment or device (10)
Manufacturer's ID (1)	x	x	x	x	x
Model Designation and Prefix (1)	x	x	x	x	x
Serial Number and Prefix (2)	x	x	x	x	x (16)
Accuracy Class (17)	x	x (8)	x (19)	x	
Nominal Capacity (3)(18)(20)	x	x	x		
Value of Scale Division, “d” (3)	x	x			
Value of "e" (4)	x	x			
Temperature Limits (5)	x	x	x	x	
Concentrated Load Capacity (CLC) (12)(20)		x	x (9)		
Special Application (13)	x	x	x		
Maximum Number of Scale Divisions (n_{max}) (6)		x (8)	x (19)	x	
Minimum Verification Scale Division (e_{min})			x (19)		
"S" or "M" (7)				x	
Direction of Loading (15)				x	
Minimum Dead Load				x	
Maximum Capacity				x	
Safe Load Limit				x	
Load Cell Verification Interval (v_{min}) (21)				x	
Section Capacity (14)(20)		x	x		

Scales

Table S.6.3.b

Notes For Table S.6.3.a.

1. *Manufacturer's identification and model designation and model designation prefix.*

2. *Serial number and prefix.*

3.. The nominal capacity *and value of the scale division shall be shown together (e.g., 50 000 x 5 kg, 100 000 x 10 lb, 15 x 0.005 kg, or 30 x 0.01 lb) adjacent to the weight display when the nominal capacity and value of the scale division are not immediately apparent. Each scale division value or weight unit shall be marked on multiple range or multi-interval scales.*

4. *Required only if different from "d."*

5. *Required only on Class III, III L, and IIII devices if the temperature range on the NTEP CC is narrower then and within –10 °C to 40 °C (14 °F to 104 °F).*

6. *This value may be stated on load cells in units of 1 000; e.g., n: 10 is 10 000 divisions.*

7. *Denotes compliance for single or multiple load cell applications. It is acceptable to use a load cell with the "S" or Single Cell designation in multiple load cell applications as long as all other parameters meet applicable requirements. A load cell with the "M" or Multiple Cell designation can be used only in multiple load cell applications.*

8. *An indicating element not permanently attached to a weighing element shall be clearly and permanently marked with the accuracy Class of I, II, III, III L, or IIII, as appropriate, and the maximum number of scale divisions, n_{max}, for which the indicator complies with the applicable requirement. Indicating elements that qualify for use in both Class III and III L applications may be marked III/III L and shall be marked with the maximum number of scale divisions for which the device complies with the applicable requirements for each accuracy class.*

9. *For vehicle, axle-load, and livestock scales only. The CLC shall be added to the load-receiving element of any such scale not previously marked at the time of modification.*

10. Necessary to the weighing system but having no metrological effect, e.g., auxiliary remote display, keyboard, etc.

11. *The markings may be either on the load cell or in an accompanying document; except that, if an accompanying document is provided, the serial number shall appear both on the load cell and in the document. The manufacturer's name or trademark, the model designation, and identifying symbol for the serial number shall also be marked both on the load cell and in any accompanying document.*

12. Required on the indicating element *and the load-receiving element* of vehicle, axle-load, and livestock scales. *Such marking shall be identified as "concentrated load capacity" or by the abbreviation "CLC".*

13. *A scale designed for a special application rather than general use shall be conspicuously marked with suitable words visible to the operator and customer restricting its use to that application, e.g., postal scale, prepack scale, weight classifier, etc. When a scale is installed with an operational counting feature, the scale shall be marked on both the operator and customer side with the statement "The counting feature is not legal for trade."*

14. Required on the indicating element of railway track scales only. When marked on vehicle, axle-load, and livestock scales manufactured before January 1, 1989, it may be used as the CLC.

Scales

Table S.6.3.b

Notes For Table S.6.3.a. (Continued)

15. *Required if the direction of loading the load cell is not obvious.*

16. *Serial number and prefix.* Modules without "intelligence" on a modular system (e.g., printer, keyboard module, cash drawer, and secondary display in a point-of-sale system) are not required to have serial numbers.

17. *The accuracy Class of a device shall be marked on the device with the appropriate designation as I, II, III, III L, or IIII.*

18. The nominal capacity shall be conspicuously marked as follows:

    (a) on any scale equipped with unit weights or weight ranges;
    (b) on any scale with which counterpoise or equal-arm weights are intended to be used;
    (c) on any automatic-indicating or recording scale so constructed that the capacity of the indicating or recording element, or elements, is not immediately apparent;
    (d) on any scale with a nominal capacity less than the sum of the reading elements; and
    (e) on the load-receiving element (weigh-bridge) of vehicle, axle-load, and livestock scales.

19. *Nonretroactive as of January 1, 1988*.

20. *Combination vehicle/railway track scales must be marked with both the nominal capacity and CLC for vehicle weighing and the nominal capacity and section capacity for railway weighing. All other requirements relating to these markings will apply.*

21. The value of the load cell verification interval (v_{min}) must be stated in mass units. In addition to this information, a device may be marked with supplemental representations of v_{min}.

Scales

Table T.1.1
Tolerances for Unmarked Scales

Type of Device	Subcategory	Min. Tol.	Accept. Tol.	Maint. Tol.	Decreasing Load Multiplier[1]	Other Applicable Requirements
Vehicle, axle-load, livestock, railway track (weighing statically), crane, and hopper (other than grain hopper)		Class III L, T.N.3.1 (Table 6) and T.N.3.2.			1.0	T.N.2., T.N.3., T.N.4.1., T.N.4.2., T.N.4.3., T.N.4.4., T.N.5., T.N.7.2.
Grain test scales	$n \leq 10\,000$ $n > 10\,000$	Class III, T.N.3.1. (Table 6) and T.N.3.2. Class II, T.N.3.1. (Table 6) and T.N.3.2.			1.0	
Railway track scales Weighing in motion		T.N.3.6. except that for T.N.3.6.2. (a), no single error shall exceed four times the maintenance tolerance.			1.0	
Monorail Scales, In-Motion		T.N.3.8.			1.0	
Customer-Operated Bulk-Weighing Systems for Recycled Materials		± 5% of applied material test load. Average error on 10 or more test loads ≤ 2.5%.			1.0	
Wheel-load weighers and Portable axle-load Scales	Tested individually or in pairs[2]	0.5d or 50 lb, whichever is greater	1% of test load	2% of test load	1.5	
Prescription scales		0.1 grain (6 mg)	0.1% of test load	0.1% of test load	1.5	
Jewelers' scales	Graduated	0.5d	0.05% of test load	0.05% of test load	1.5	
	Ungraduated	Sensitivity or smallest weight, whichever is less				
Dairy-product-test scale	Loads < 18 g 18 g load	0.2 grain 0.2 grain	0.2 grain 0.3 grain	0.2 grain 0.5 grain	1.5	
Postal and parcel post scales Designed/used to weigh loads < 2 lb	Loads < 2 lb	15 grain, 1 g, 1/32 oz, 0.03 oz, or 0.002 lb	15 grain, 1 g, 1/32 oz, 0.03 oz, or 0.002 lb	15 grain, 1 g, 1/32 oz, 0.03 oz, or 0.002 lb	1.5	
	Loads ≥ 2 lb	Table 5	Table 5	Table 5		
Other postal and parcel post scales		Table 5	Table 5	Table 5	1.5	
All other scales	$n > 5\,000$	0.5d or 0.05% of scale capacity, whichever is less	0.05% of test load	0.1% of test load	1.5	T.N.2.5., T.N.4.1., T.N.4.2., T.N.4.3., T.N.5., T.N.7.2.
	$n \leq 5\,000$	Class III, T.N.3.1., Table 6 and T.N.3.2.			1.0	T.N.2., T.N.3., T.N.4.1., T.N.4.2., T.N.4.3., T.N.5., T.N.7.2.

[1] The decreasing load test applies only to automatic indicating scales.
[2] If marked and tested as a pair, the tolerance shall be applied to the sum of the indications.

Scales

Table UR.3.2.1. Span Maximum Load

Distance in feet between the extremes of any group of 2 or more consecutive axles	Ratio of CLC to maximum load ("r" factor) carried on any group of 2 or more consecutive axles							
	2 axles	3 axles	4 axles	5 axles	6 axles	7 axles	8 axles	9 axles
4[1]	1.000							
5[1]	1.000							
6[1]	1.000							
7[1]	1.000							
8 and less[1]	1.000	1.000						
More than 8[1]	1.118	1.235						
9	1.147	1.257						
10	1.176	1.279						
11	1.206	1.301						
12	1.235	1.324	1.471	1.632				
13	1.265	1.346	1.490	1.651				
14	1.294	1.368	1.510	1.669				
15	1.324	1.390	1.529	1.688	1.853			
16	1.353	1.412	1.549	1.706	1.871			
17	1.382	1.434	1.569	1.724	1.888			
18	1.412	1.456	1.588	1.743	1.906			
19	1.441	1.478	1.608	1.761	1.924			
20	1.471	1.500	1.627	1.779	1.941			
21	1.500	1.522	1.647	1.798	1.959			
22	1.529	1.544	1.667	1.816	1.976			
23	1.559	1.566	1.686	1.835	1.994			
24	1.588	1.588	1.706	1.853	2.012	2.176		
25	1.618	1.610	1.725	1.871	2.029	2.194		
26		1.632	1.745	1.890	2.047	2.211		
27		1.654	1.765	1.908	2.065	2.228		
28		1.676	1.784	1.926	2.082	2.245	2.412	
29		1.699	1.804	1.945	2.100	2.262	2.429	
30		1.721	1.824	1.963	2.118	2.279	2.445	
31		1.743	1.843	1.982	2.135	2.297	2.462	
32		1.765	1.863	2.000	2.153	2.314	2.479	2.647
33			1.882	2.018	2.171	2.331	2.496	2.664
34			1.902	2.037	2.188	2.348	2.513	2.680
35			1.922	2.055	2.206	2.365	2.529	2.697
36			2.000[2]	2.074	2.224	2.382	2.546	2.713
37			2.000[2]	2.092	2.241	2.400	2.563	2.730
38			2.000[2]	2.110	2.259	2.417	2.580	2.746
39			2.000	2.129	2.276	2.434	2.597	2.763
40			2.020	2.147	2.294	2.451	2.613	2.779
41			2.039	2.165	2.312	2.468	2.630	2.796
42			2.059	2.184	2.329	2.485	2.647	2.813
43			2.078	2.202	2.347	2.502	2.664	2.829
44			2.098	2.221	2.365	2.520	2.681	2.846
45			2.118	2.239	2.382	2.537	2.697	2.862
46			2.137	2.257	2.400	2.554	2.714	2.879
47			2.157	2.276	2.418	2.571	2.731	2.895
48			2.176	2.294	2.435	2.588	2.748	2.912
49			2.196	2.313	2.453	2.605	2.765	2.928
50			2.216	2.331	2.471	2.623	2.782	2.945

INSTRUCTIONS:

1. Determine the scale's CLC.
2. Count the number of axles on the vehicle in a given span and determine the distance in feet between the first and last axle in the span.
3. Multiply the CLC by the corresponding multiplier in the table*.
4. The resulting number is the scale's maximum concentrated load for a single span based on the vehicle configuration.

*See note and formula on next page.

Scales

Table UR.3.2.1 Span Maximum Load								
Distance in feet between the extremes of any group of 2 or more consecutive axles	**Ratio of CLC to maximum load ("r" factor) carried on any group of 2 or more consecutive axles**							
	2 axles	3 axles	4 axles	5 axles	6 axles	7 axles	8 axles	9 axles
51			2.235	2.349	2.488	2.640	2.798	2.961
52			2.255	2.368	2.506	2.657	2.815	2.978
53			2.275	2.386	2.524	2.674	2.832	2.994
54			2.294	2.404	2.541	2.691	2.849	3.011
55			2.314	2.423	2.559	2.708	2.866	3.028
56			2.333	2.441	2.576	2.725	2.882	3.044
57			2.353[3]	2.460	2.594	2.742	2.899	3.061
58				2.478	2.612	2.760	2.916	3.077
59				2.496	2.629	2.777	2.933	3.094
60				2.515	2.647	2.794	2.950	3.110

* Note: This table was developed based upon the following formula. Values may be rounded in some cases for ease of use.

$$W = r \; x \; 500 \left| \left(\frac{LN}{N - 1} \right) + 12N + 36 \right|$$

[1] Tandem Axle Weight.
[2] Exception - These values in the third column correspond to the maximum loads in which the inner bridge dimensions of 36, 37, and 38 feet are considered to be equivalent to 39 feet. This allows a weight of 68 000 lb on axles 2 through 5.
[3] Corresponds to the Interstate Gross Weight Limit.

Scales

Table T.N.8.1.2 Temperature Range by Class	
Class	Temperature Range
I	5 °C (9 °F)
II	15 °C (27 °F)
III, III L, & IIII	30 °C (54 °F)

Table 1 Minimum Travel of Weighbeam of Beam Scale Between Limiting Stops	
Distance from weighbeam fulcrum to limiting stops (inch)	Minimum travel Between limiting stops (inch)
12 or less	0.4
12+ to 20, inclusive	0.5
20+ to 40, inclusive	0.7
Over 40	0.9

Table 1M Minimum Travel of Weighbeam of Beam Scale Between Limiting Stops	
Distance from weighbeam Fulcrum to limiting stops (centimeter)	Minimum travel between limiting stops (millimeter)
30 or less	10
30+ to 50, inclusive	13
50+ to 100, inclusive	18
Over 100	23

Scales

Table 2 Minimum Travel of Pans of Nonautomatic Indicating Equal-Arm Scale Without Balance Indicator	
Nominal capacity (pounds)	Minimum travel of pans (inch)
4 or less	0.35
4+ to 12, inclusive	0.5
12+ to 26, inclusive	0.75
Over 26	1.0

Table 2M Minimum Travel of Pans of Nonautomatic Indicating Equal-Arm Scale Without Balance Indicator	
Nominal capacity (kilograms)	Minimum travel of pans (millimeters)
2 or less	9
2+ to 5, inclusive	13
5+ to 12, inclusive	19
Over 12	25

Scales

Table 3 Parameters for Accuracy Classes			
Class	Value of the verification *scale division (d or e[1])*	*Number of scale[4] divisions (n)*	
		Minimum	*Maximum*
SI Units			
I	*equal to or greater than 1 mg*	*50 000*	------
II	*1 to 50 mg, inclusive*	*100*	*100 000*
	equal to or greater than 100 mg	*5000*	*100 000*
III[2]	*0.1 to 2 g, inclusive*	*100*	*10 000*
	equal to or greater than 5 g	*500*	*10 000*
III L[3]	*equal to or greater than 2 kg*	*2000*	*10 000*
IIII	*equal to or greater than 5 g*	*100*	*1 200*
INCH-POUND Units			
III	*0.0002 lb to 0.005 lb, inclusive*	*100*	*10 000*
	0.005 oz to 0.125 oz, inclusive	*100*	*10 000*
	equal to or greater than 0.01 lb	*500*	*10 000*
	equal to or greater than 0.25 oz	*500*	*10 000*
III L[3]	*equal to or greater than 5 lb*	*2 000*	*10 000*
IIII	*greater than 0.01 lb*	*100*	*1 200*
	greater than 0.25 oz	*100*	*1 200*

[1] For Class I and II devices equipped with auxiliary reading means (i.e., a rider, a vernier, or a least significant decimal differentiated by size, shape, or color), the value of the verification scale division "e" is the value of the scale division immediately preceding the auxiliary means.

[2] A scale marked "For prescription weighing only" may have a scale division not less than 0.01 g.

[3] The value of a scale division for crane and hopper (other than grain hopper) scales shall be not less than 0.2 kg (0.5 lb). The minimum number of scale divisions shall be not less than 1000.

[4] On a multiple range or multi-interval scale the number of divisions for each range independently shall not exceed the maximum specified for the accuracy class. The number of scale divisions, n, for each weighing range is determined by dividing the scale capacity for each range by the verification scale division, e, for each range. On a scale system with multiple load receiving elements and multiple indications, each element considered shall not independently exceed the maximum specified for the accuracy class. If the system has a summing indicator, the n_{max} for the summed indication shall not exceed the maximum specified for the accuracy class.

Scales

Table 5
Maintenance and Acceptance Tolerances for Unmarked
Postal and Parcel Post Scales

Scale Capacity (lb)	Test loads (lb)	Maintenance tolerance (±) (oz)	Maintenance tolerance (±) (lb)	Acceptance tolerance (±) (oz)	Acceptance tolerance (±) (lb)
0 to 4, inclusive*	0 to 1, inclusive	1/32	0.002	1/32	0.002
	over 1	1/8	0.008	1/16	0.004
over 4*	0 to 7, inclusive	3/16	0.012	3/16	0.012
	7+ to 24, inclusive	3/8	0.024	3/16	0.012
	24+ to 30, inclusive	1/2	0.030	1/4	0.015
	over 30	0.1% of Test Load		0.05% of Test Load	

*See Table T.1.1. for scales designed and/or used to weigh loads less than 2 lb.

Table 6
Maintenance Tolerances
(All values in this table are in scale divisions)

	Tolerance in Scale Divisions			
	1	2	3	4
Class	Test Load			
I	0 – 50 000	50 001 - 200 000	200 001 +	
II	0 – 5 000	5 001 - 20 000	20 001 +	
III	0 – 500	501 - 2 000	2 001 - 4 000	4 001 +
IIII	0 – 50	51 - 200	201 - 400	401 +
III L	0 – 500	501 - 1 000	(Add 1d for each additional 500d or fraction thereof)	